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Docket No.: YAF-025-US
IWA.006

REMARKS

An excess claim fee payment letter is submitted herewith for four (4) excess independent claims.

Claims 1-20 are all the claims presently pending in the application. Claims 1-20 have been amended to more particularly define the invention.

It is noted that the claim amendments herein or later are not made to distinguish the invention over the prior art or narrow the claims or for any statutory requirements of patentability. Further, Applicant specifically states that no amendment to any claim herein or later should be construed as a disclaimer of any interest in or right to an equivalent of any element or feature of the amended claim.

Applicant gratefully acknowledges that claims 4-5 and 12-15 would be allowable if rewritten in independent form. Accordingly, claims 4-5 and 12-15 have been rewritten in independent form. Notwithstanding, Applicant respectfully submits that all of the claims presently pending are allowable.

With respect to prior art rejections, claims 1-2, 9 and 19 stand rejected under 35 U.S.C. §102(b) as being anticipated by Taniguchi (U.S. Patent No. 4,976,595) or JP 589 (JP 64-056589). Claims 3, 6-8, 11 and 16-18 stand rejected under 35 U.S.C. §103(a) as being unpatentable over Taniguchi in view of design choice. Claims 10 and 20 stand rejected under 35 U.S.C. §103(a) as being unpatentable over JP 589 in view of design choice.

These rejections are respectfully traversed in the following discussion.

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I. THE CLAIMED INVENTION

An exemplary aspect of the present invention, as recited in claim 1, is directed to a trochoidal pump comprising an inner rotor and an outer rotor having trochoidal toothed shapes, the inner rotor and outer rotor being provided in a mutually intermeshing state such that a normal tip clearance occurs between each tooth crest of the inner rotor and the outer rotor. At least one tip end of the plurality of tooth crests on at least one of the inner rotor and outer rotor is selected appropriately and retracted such that a large clearance, which is a larger gap than the normal tip clearance, is provided by the tooth crest on the at least one of the inner rotor and outer rotor having the retracted tip end.

Conventional trochoidal pumps set the prescribed tip clearance equally for each of the respective teeth. By setting this tip clearance to a suitable level, it is possible to reduce pulsation, and hence noise. However, the pump performance is reduced by increasing the tip clearance, while decreasing the tip clearance makes the suppression of pulsation and noise difficult. These mutually contradictory conditions make it extremely difficult to establish an optimum tip clearance. (See Application at page 2, line 19-25 and page 3, line 1-2)

Further, since the tip clearance in conventional pumps is set uniformly at the respective teeth of the inner rotor and outer rotor when the pump rotates, a systematic pulsation is generated by the uniformly established tip clearances. When the pressurized fluid generating this systematic pulsation is discharged from the pump, resonance is liable to occur in both the pump and the fluid supply device. Thus, it is difficult to prevent the generation of noise in such conventional trochoidal pumps. (See Application at page 3, lines 3-13)

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The claimed invention, on the other hand, provides a trochoidal pump including at least one tip end of the plurality of tooth crests on the inner rotor and/or outer rotor selected appropriately and retracted such that a large clearance, which is a larger gap than the normal tip clearance, is provided by the tooth crest on at least one of the inner rotor and outer rotor having the retracted tip end. This feature, amongst others, creates a pulsation having a non-regular cycle, thus preventing resonance. In this manner, noise can be suppressed to a low level. Additionally, the lifespan of the pump and peripheral devices can be greatly improved. (See Application at page 26, lines 10-22)

II. THE 35 USC §112, SECOND PARAGRAPH REJECTION

Claims 1-20 stand rejected under 35 U.S.C. §112, second paragraph, as being indefinite. The claims have been amended, above, to overcome this rejection. Specifically, claims 3 and 11 have been amended to eliminate the alternative language cited by the Examiner. Additionally, independent claim 1 has been amended to more particularly define the large clearance, as requested by the Examiner.

In view of the foregoing, the Examiner is respectfully requested to reconsider and withdraw this rejection.

III. THE PRIOR ART REFERENCES

A. The Taniguchi Reference

The Examiner alleges that the invention of claims 1, 2, 9 and 19 are anticipated by Taniguchi, and that claims 3, 6-8, 11 and 16-18 are unpatentable over Taniguchi in view of

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design choice. However, Applicant respectfully submits that the reference does not teach or suggest each and every element of the claimed invention.

1. The 35 U.S.C. §102(b) Rejection

Taniguchi discloses a trochoidal pump having an inner rotor and an outer rotor incorporated eccentrically to each other within a housing bore of a pump housing. (See Taniguchi at Abstract)

However, Taniguchi does not teach or suggest that at least one tip end of the plurality of tooth crests on at least one of the inner rotor and outer rotor is selected appropriately and retracted such that a large clearance, which is a larger gap than the normal tip clearance, is provided by the tooth crest on the at least one of the inner rotor and outer rotor having the retracted tip end, as recited in claims 1, 2, 9 and 19.

Rather, Taniguchi expresses the difference in the size of a tip clearance depending on the intermeshing rotary position of an inner rotor and an outer rotor.

Taniguchi discloses that when a tip end 18b of the inner rotor and a tip end 20b of the outer rotor are opposed to each other, a maximum inter-tip distance Tmax ($T_{max} = T_1 + T_2$) between the tip end 18b of the inner rotor and the tip end 20b of the outer rotor is set to be larger than a maximum circumferential distance B between an outer periphery 20c of the outer rotor and an inner periphery 24c of a housing section 24. Therefore, when the tip end 18b of the inner rotor comes closer to the tip end 20b of the outer rotor through rotation of the outer rotor in conjunction with the rotation of the inner rotor, it can be ensured that the inter-tip distance T_1 will be equal to or greater than zero. (See Taniguchi at column 4, lines 45-61)

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As a result, interference between the teeth of the inner rotor and the teeth of the outer can be avoided even when the outer rotor moves irregularly, and hence the teeth 18a of the inner rotor and the teeth 20a of the outer rotor are in a regular intermeshing engagement. (See Taniguchi at column 4, lines 62-68)

Further, when the maximum inter-tip distance T_{max} and the maximum circumferential distance B have a relationship of $T_{max} \leq B$, a center i of the inner rotor 18, a center of the outer rotor, and a center P of the housing section are arranged in a regular relationship, and hence trochoidal interference can be prevented. (See Taniguchi at column 5, lines 11-31)

In other words, in Taniguchi the inter-tip distance T_1 between the inner rotor and the outer rotor is set to no less than zero in accordance with the circumferential distance between the outer periphery of the outer rotor and the inner periphery of the housing section.

Moreover, the intermeshing rotor teeth of the inner rotor and the outer rotor are all formed in the same size, with the same shape, and in an entirely uniform arrangement. Indeed, Taniguchi makes no reference or suggestion that at least one tip end of the tooth crests on the outer rotor or inner rotor is selected appropriately and retracted to provide a large clearance, as in claims 1, 2, 9 and 19.

As noted above, when the tip clearance is set uniformly at the respective teeth of the inner rotor and outer rotor when the pump rotates, a systematic pulsation is generated by the uniformly established tip clearances. When the pressurized fluid generating this systematic pulsation is discharged from the pump, resonance is liable to occur in both the pump and the fluid supply device and generate noise.

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Clearly, Taniguchi does not teach or suggest that at least one tip end of the plurality of tooth crests on at least one of the inner rotor and outer rotor is selected appropriately and retracted such that a large clearance, which is a larger gap than the normal tip clearance, is provided by the tooth crest on the at least one of the inner rotor and outer rotor having the retracted tip end, as recited in claims 1, 2, 9 and 19, in order to create a pulsation having a non-regular cycle, thus preventing resonance and suppressing the associated noise.

Further, Taniguchi discloses that the teeth of the inner rotor and the teeth of the outer rotor intermesh regularly when the tip ends of the inner rotor and the outer rotor are opposed to each other.

In contrast, the large clearance of claims 1, 2, 9 and 19 moves with the intermeshing rotation of the inner rotor and outer rotor, and hence alters the phase.

As noted, by disrupting the regularity of the hydraulic pulse of the pump, resonance produced by the pulse can be prevented, and hence noise can be reduced.

In light of the above, Applicant submits that there are elements of the claims 1, 2, 9 and 19 that are not taught or suggested by Taniguchi. Therefore, the Examiner is respectfully requested to withdraw this rejection.

2. The 35 U.S.C. §103(a) Rejection

The Examiner concedes that Taniguchi does not teach or suggest the large clearance being arranged in a uniform or non-uniform fashion on appropriate tooth crests of the teeth, and a plurality of large clearances having the same or different interval dimension, as recited in claims 3, 6-8, 11 and 16-18.

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Rather, the Examiner takes the position that one having ordinary skill in the art would have found it obvious to utilize the large clearance being arranged in a uniform or non-uniform fashion and a plurality of large clearances having the same or different interval dimension since such are allegedly merely design parameters dependent upon temperature, pressure, or stress acted/applied on the inner/outer rotors or the output requirements of the pump. The Examiner further asserts that the claimed uniform or non-uniform fashion of the large clearance or plurality of large clearances do not present a novel or unexpected result.

Applicant respectfully submits that providing the large clearance being arranged in a uniform or non-uniform fashion and a plurality of large clearances having the same or different interval dimension, as in claims 3, 6-8, 11 and 16-18, is not a design choice, as alleged by the Examiner.

As noted above, this feature, amongst others, creates a pulsation having a non-regular cycle, thus preventing resonance and suppressing the associated noise. Indeed, no person of ordinary skill in the art would have considered including such features to achieve the benefits of the claimed invention, absent impermissible hindsight.

In fact, Applicant submits that the Examiner can point to no motivation or suggestion in Taniguchi to urge the alleged design choices asserted by the Examiner. Indeed, contrary to the Examiner's allegations, neither Taniguchi nor mere design choice teach or suggest these features.

Therefore, Applicant respectfully submits that one of ordinary skill in the art would not have been so motivated to apply design choice to Taniguchi as alleged by the Examiner and, therefore, the Examiner has failed to make a prima facie case of obviousness.

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Furthermore, Applicant respectfully submits that design choice does not make up for the deficiencies of Taniguchi described above directed toward providing at least one tip end of the plurality of tooth crests on at least one of the inner rotor and outer rotor is selected appropriately and retracted such that a large clearance, which is a larger gap than the normal tip clearance, is provided by the tooth crest on the at least one of the inner rotor and outer rotor having the retracted tip end, as in the claims 3, 6-8, 11 and 16-18.

As noted above, in Taniguchi the intermeshing rotor teeth of the inner rotor and outer rotor are all formed in the same size, with the same shape, in an entirely uniform arrangement. Therefore, regular intermeshing occurs.

In essence, Taniguchi discloses a conventional pump having the very problems which the present invention addresses. Namely, when the tip clearance is set uniformly at the respective teeth of the inner rotor and outer rotor when the pump rotates, a systematic pulsation is generated by the uniformly established tip clearances which creates resonance.

In contrast, the large clearance of the present invention moves with the intermeshing rotation of the inner rotor and outer rotor, and therefore the phase is altered by setting the position and gap dimension of the large clearance.

As noted above, by disrupting the regularity of the hydraulic pulse of the pump, resonance produced by the pulse can be prevented, and hence noise can be reduced. These features are not described or even suggested in Taniguchi, and would therefore be difficult to infer, as alleged by the Examiner. Applicant respectfully submits that it would not have been obvious (i.e. nothing more than design parameters) to a person skilled in the art to incorporate the claimed features to achieve the benefits of the claimed invention.

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In light of the above, Applicant submits that there are elements of the claims 3, 6-8, 11 and 16-18 that are not taught or suggested by Taniguchi or by design choice, and the Examiner is respectfully requested to withdraw this rejection.

B. The JP 589 Reference

The Examiner alleges that the invention of claims 1, 2, 9 and 19 are anticipated by JP 589, and that claims 10 and 20 are unpatentable over JP 589 in view of design choice. However, Applicant respectfully submits that the reference does not teach or suggest each and every element of the claimed invention.

1. The 35 U.S.C. §102(b) Rejection

Applicant submits that JP 589 does not teach or suggest that at least one tip end of the plurality of tooth crests on at least one of the inner rotor and outer rotor is selected appropriately and retracted such that a large clearance, which is a larger gap than the normal tip clearance, is provided by the tooth crest on the at least one of the inner rotor and outer rotor having the retracted tip end, as recited in claims 1, 2, 9 and 19.

Rather, JP 589 discloses a trochoidal pump fitted with an inner rotor and outer rotor having a trochoidal toothed shape wherein a rear side surface of each tooth of an inner rotor in the driving direction is formed as a simple arc about a single point, and the height of this part is formed to be lower than the tooth shape produced by the trochoidal curve. (See JP 589 at Figures 1-7 and Application at page 1, lines 9-18)

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In JP 589, when a space portion 5 between two points of the two respective rotors 1, 1' and 2, 2' is closed, a gap S2 between tooth crests on a discharge side is wide, and a gap S3 between tooth crests on an intake side is narrow, due to the low tooth surface on the rear side surface of the inner rotor in the driving direction. (See JP 589 at Figures 1-7)

However, in JP 589, the intermeshing rotor teeth of the inner rotor and outer rotor disclosed in JP 589 are all formed in the same size with the same shape, in an entirely uniform arrangement.

Accordingly, the gaps S2, S3 in the intermeshing of the inner rotor and outer rotor appear regularly in fixed positions, and therefore produce a regular pulse which creates resonance.

The present invention differs clearly from JP 589 in that at least one tip end of the plurality of tooth crests on at least one of the inner rotor and outer rotor is selected appropriately and retracted such that a large clearance, which is a larger gap than the normal tip clearance, is provided by the tooth crest on the at least one of the inner rotor and outer rotor having the retracted tip end in order to create a pulsation having a non-regular cycle, thus preventing resonance and suppressing the associated noise.

Furthermore, the clearances disclosed in JP 589 each have a predetermined magnitude in regular, fixed positions according to the intermeshing of the inner rotor and the outer rotor.

In contrast, the large clearance in the claimed invention move with the intermeshing rotation of the inner rotor and outer rotor, thereby altering the pulse.

As noted above, by disrupting the regularity of the hydraulic pulse of the pump, resonance produced by the pulse can be prevented, and hence noise can be reduced.

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As can be seen from the above, the present invention is clearly neither disclosed nor suggested in any way in JP 589. It is clear that independent claim 1, along with dependent claims 2, 9 and 19 in the present invention, are neither disclosed nor suggested in by JP 589.

In light of the above, Applicant submits that there are elements of claims 1, 2, 9 and 19 that are not taught or suggested by JP 589. Therefore, the Examiner is respectfully requested to withdraw this rejection.

2. The 35 U.S.C. §103(a) Rejection

The Examiner concedes that JP 589 does not teach or suggest a large clearance being formed by retracting the circumferential edges of both tooth crests of the inner and outer rotors, as in claims 10 and 20.

Rather, the Examiner takes the position that one having ordinary skill in the art would have found it obvious to utilize the large clearance being formed by retracting the circumferential edges of both tooth crests of the inner and outer rotors, since such are allegedly merely design parameters dependent upon a particular purpose or solving a stated problem. The Examiner further asserts that the claimed large clearance does not present a novel or unexpected result.

Applicant respectfully submits that providing the large clearance being formed by retracting the circumferential edges of both tooth crests of the inner and outer rotors, as in the claims 10 and 20, is not a design choice.

As noted above, this feature, amongst others, creates a pulsation having a non-regular cycle, thus preventing resonance and suppressing the associated noise. Indeed, no person of

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ordinary skill in the art would have considered including such features to achieve the benefits of the claimed invention, absent impermissible hindsight.

In fact, Applicant submits that the Examiner can point to no motivation or suggestion in JP 589 to urge the alleged design choices asserted by the Examiner. Indeed, contrary to the Examiner's allegations, neither JP 589 nor mere design choice teach or suggest the large clearance being formed by retracting the circumferential edges of both tooth crests of the inner and outer rotors, as recited in claims 10 and 20.

Therefore, Applicant respectfully submits that one of ordinary skill in the art would not have been so motivated to apply design choice to JP 589 as alleged by the Examiner and, therefore, the Examiner has failed to make a prima facie case of obviousness.

Furthermore, Applicant respectfully submits that design choice does not make up for the deficiencies of JP 589 described above directed toward providing at least one tip end of the plurality of tooth crests on at least one of the inner rotor and outer rotor is selected appropriately and retracted such that a large clearance, which is a larger gap than the normal tip clearance, is provided by the tooth crest on the at least one of the inner rotor and outer rotor having the retracted tip end, as in the claims 10 and 20.

Rather, In JP 589, a rear side surface of each tooth of an inner rotor in the driving direction is formed as a simple arc about a single point, and the height of this part is formed to be lower than the tooth shape produced by the trochoidal curve. As a result, the radius R2 of the tooth bottom surface is increased by a maximum of approximately 0.5mm.

In other words, JP 589 describes retracting the tooth crest and deepening the tooth bottom surface of each inner rotor tooth, and also describes the relationship between the

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radius of each outer rotor tooth shape and the radius of each inner rotor tooth shape.

By retracting the rear side surface of each tooth of the inner rotor in the driving direction by means of an arc, and the relationship between the radius of each outer rotor tooth shape and the radius of each inner rotor tooth shape, disclosed in the cited example, it can be inferred that each outer rotor tooth (i.e. all tooth crests) is retracted in the same fashion on the inner rotor.

Thus, the large clearances between each tooth that would be formed by retracting each inner rotor tooth and each outer rotor tooth in this manner would appear in regular, fixed positions.

In other words, the tip clearances between each tooth would all be increased considerably, and it would therefore be difficult to maintain pumping capability. Conversely, if each of the tip clearances were reduced, it would be difficult to reduce pulse and noise.

In the claimed invention, the large clearance is provided appropriately between at least one of the teeth of at least one of the inner and outer rotors, rather than all of the teeth of the two rotors. Moreover, the large clearance moves with the intermeshing rotation of the rotors, and in so doing alters the phase.

Thus, the large clearance is capable of increasing the irregularity of the pulse produced during the operation of the pump, thereby preventing resonance and suppressing noise.

In light of the above, Applicant submits that there are elements of claims 10 and 20 that are not taught or suggest by JP 589. Therefore, the Examiner is respectfully requested to withdraw this rejection.

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IV. FORMAL MATTERS AND CONCLUSION

Applicant notes that the present Application claims foreign priority benefits under 35 U.S.C. § 119 of Japanese Patent Application 2002-203264 filed July 11, 2002 and Japanese Patent Application 2003-174279 filed June 19, 2003, certified copies of which were submitted on October 10, 2003. Applicant respectfully requests the Examiner to acknowledge on the Office Action Summary (form PTOL-326) that all the priority documents have been received.

In view of the foregoing, Applicant submits that claims 1-20, all the claims presently pending in the application, are patentably distinct over the prior art of record and are allowable, and that the application is in condition for allowance. Such action would be appreciated.

Should the Examiner find the application to be other than in condition for allowance, the Examiner is requested to contact the undersigned attorney at the local telephone number listed below to discuss any other changes deemed necessary for allowance in a telephonic or personal interview.

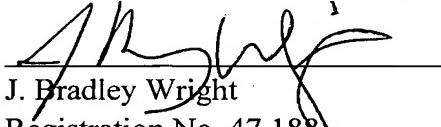
To the extent necessary, Applicant petitions for an extension of time under 37 CFR §1.136. The Commissioner is authorized to charge any deficiency in fees, including

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extension of time fees, or to credit any overpayment in fees to Attorney's Deposit Account
No. 50-0481.

Respectfully Submitted,

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